The Study of Greek Fortifications

A review article

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The world of the ancient Greeks, whether before or after the lifetime of Alexander the Great, was, on the whole, without a pax Graeca, and most towns and cities were at one time or another protected by a circuit wall, and sometimes by a few signal towers in the chora or — perhaps — by a chain of frontier forts. Within the heritage of Greek civilization no class of monuments or architectural achievements stands out more conspicuously than that of city walls, of field fortifications and of walls enclosing an entire oasis. If for modern tourists with their esthetic predilection these defence works do not rank high, it was different for travellers of the nineteenth and early twentieth centuries, who showed a deep interest in military remains.

In the twentieth century scholars began to concentrate on individual fortified sites; Krischen for instance published a monograph on the fortifications of Herakleia-on-Mt Latmos (1922) and Von Gerkan wrote studies on the city walls of Miletus (1935) and of Dura-Europos (1939). Most circuits remain virtually unpublished or are known only sketchily. This also applies to those in Greece itself and to fortifications on the islands of the Aegean Sea. In recent years a group of scholars with intimate knowledge of ancient artillery, of Greek city wall architecture and also of the pertinent archaeological terrains published comprehensive works in which personal observation, comparison, interpretation and theory reached new and high levels: F.G. Maier (1959, 1961), E.W. Marsden (1969), F.E. Winter (1971), Y. Garlan (1974), A.W. Lawrence (1979) and J.-P. Adam (1982). For the North-Eastern sector of the lands conquered by Alexander the Great H.P. Francfort’s report Les fortifications en Asie Centrale de l’âge du bronze à l’époque kouchane, Paris 1979, is a systematic survey rich in detail, while A.W. McNicoll’s doctoral dissertation Hellenistic Fortifications from the Aegean to the Euphrates (1971; unpublished; there is a copy in the Bodleian Library at Oxford) covered Asiatic regions further West. The set of works mentioned here has pushed the study of Greek fortifications to a higher grade of sophistication, representing a framework for looking at city circuits with particular questions in mind. The time was ripe for convening a conference.


The richly illustrated book reviewed here contains the lectures of a symposium where — with the exception of Professor A.W. Lawrence — the majority of students of Greek city walls were present. A number of specialists who did not have the opportunity of taking part contributed a paper in absentia. The committee which prepared the meeting requested the participants not to lose sight of the general issues. The conference considered questions such as: was the erection of a city wall cost-effective? which was the manpower involved in building an enceinte? what was the relationship between the number of defenders and the length of a city wall? in what ways did building materials and their use affect construction? how did the new technology of offensive, stone-throwing catapult artillery affect cities and their fortification systems? what about defensive artillery and its effect on fortification architecture?

The symposium was also organized with a second purpose in mind: attention was not drawn particularly to Greece itself but rather to the distant regions where the Greeks founded colonies and to the lands conquered by Alexander the Great. Apart

1 For a newly published circuit, that of Hyettos in Boeotia, see Étienne and Knoepfler 1976, 45-65. L’acropole et son enceinte, with fig. 9.
2 The untimely death of the author is a great loss to archaeology. For an obituary see Hennessy 1988. For a summary of his ideas on city defences see McNicoll 1972; McNicoll 1978; and pages 305-313 of the book under review ‘Developments in Techniques of Siegecraft and Fortification in the Greek World ca. 400-100 B.C.’ See also McNicoll and Winkoff 1983. Finally, see McNicoll 1983.
3 Knowledge of arrow-shooting catapults has recently been extended by two groups of finds of the Hellenistic period, see Baatz 1982 and Baatz 1985.
4 For a comprehensive report on a local colonial area see Kirigin (Split) 1990 with sketch plans of the fortification circuits of the colonial towns.
from that, Greek fortification technology is now known to have spread beyond the fringes of the Greek world to lands inhabited by non-Greeks, to Caucasian Georgia for instance. As a result of its wide horizon the contributions in this volume range from Afghanistan to Morocco and Spain, from Tunisia to Rumania, from Libya to Soviet Russia. The book contains contributions in French (34), in Italian (5), in English (5) and in German (2).

Three opening papers comment on the present situation of the study of Greek fortifications. In his introduction to the symposion P. Leriche (Paris) argues (11-14) that fortifications should not be studied as entities in themselves but as elements of society and as components of ancient warfare. Y. Garlan (Rennes) remarks (15-21) that the chronology of many circuits is unknown or uncertain, and that, on the whole, a complete city enceinte is only rarely investigated by means of a series of trial tests. He observes that in future scholars should try to reconstruct the ancient measurements as they are found for instance in Philo of Byzantium. Converting archaeological measurements taken at city walls into cubits (pechés; a cubit being one-and-a-half foot) may usually be possible. In ‘A Summary of Recent Work on Greek Fortifications in Greece and Asia Minor’ (23-29) F.E. Winter (Toronto) is somewhat sceptical about the value of pottery or coin evidence from excavations along city circuits, and he illustrates his point by reconsidering and redating successive phases of the Acrocorinth fortress. Winter further speaks of the desirability of studying harbour fortifications, outlying defences, and the shutters and chases of wall and tower windows.

I shall now summarize a series of contributions found in the book, beginning with Cyprus and with the Greek homelands, an area of which only a few sites are discussed in archaeological terms. In his paper ‘Deux nouveaux établissements fortifiés du Bronze Récent à Chypre’ (381-384) V. Kara-georghis (Nicosia) describes excavations at two thirteenth century B.C. fortified coastal sites lying in locations protected by nature (1230-1200). The pottery is Greek. Refugees from the Aegean-Anatolian world may have temporarily occupied these localities, which constituted strong defensive positions. In Greece, the number of circuits built prior to the fourth century B.C. appears to be relatively small in comparison with the great quantity of Late Classical and Early Hellenistic enceintes. In his paper ‘The Historical Significance of Fortification in Archaic Greece’ (125-131) A. Snodgrass (Cambridge) assembles what evidence there is for ninth-eighth century B.C. walls. They are restricted to Crete, to the Cyclades, and to the West coast of Asia Minor. The sites of this period do not represent an early stage of later poleis and their defence systems. They do not follow the Mycenaean fortification tradition either, constituting a class in themselves. They offered protection against attacks of pirates and of non-Greeks. It is only in Later Archaic times that defences of poleis are first recorded. These circuits, which often possessed towers, were sometimes inspired by Oriental examples. On the whole, the study of Greek Archaic fortifications is still underdeveloped. In my own contribution I briefly discuss (315-321) the archaeological survey of the fortifications of the Goritsa city in Thessaly, Greece, which was carried out in the years 1970-1981. Perched on an outspur of Mt Pelion, the city occupied a position which was strong by nature. After a description of the towers and of the curtains attention is drawn to the Great Battery, which faces the fairly flat connection with Mt Pelion and which was capacious enough to give room to two or four catapults throwing one-talent stone balls. Being a one period city Goritsa seems to have been built in the last quarter of the fourth century B.C. Soon after that it was abandoned. D. Lazaridis (Athens) reports (31-38) on large scale excavations along the city wall of Amphipolis, a makron teichos in the words of Thuc. IV, 102, 3, approximately 7,450 m. long and apparently encircling a Landschaftsstadt much of which was rural. The extant wall, which is partly of Hellenistic date, is very well preserved in places. Towers are of circular, semi-circular and of quadrangular shape. The excavations revealed large, oblong openings for draining water through the city wall.

Contributions dealing with the Easternmost parts of the ancient world are discussed in my review for BiOr. The following two papers deal with Syria. The fortifications of the ancient Greek cities of Syria cannot be seen above the present level of the ground. What is visible is the reconstruction phase of Byzantine and later date. It has been pointed out, however, that the lay-out of the great Syrian settlements and the trace of their enceintes go back to the end of the fourth or the first half

5 For three examples mentioned in this book see the circuits of Amphipolis (31-38), of Maracanda (Sogdiana) (71-78) and of Motya (West Sicily) (221-227), Garlan himself carried out this type of testing at Thasos (Garlan 1966).
6 For a recent publication of an ancient fortified harbour in Asia Minor see Schäfer et alii 1981, 63-67 with Tafel 1 and Tafel 27.
7 On shutters see Ober 1987, 578-580, 603-604.
8 For an interim report see Wokalek 1973.
9 For the final report see Bakhuizen (coord.) 1992, 89-166. The Fortifications (based on work by A. Oude Kotte) with 51-88, Quarrying and Geology.
of the third centuries B.C., when the diadochs and the Hellenistic rulers founded a series of new cities (Sauvaget 1934; Sauvaget 1941, 42-45[8]; Van Berchem 1954; Lauffray 1958[1]). Now, in a recent emergency investigation, a section of the Greek wall of Beroia-Aleppo has been excavated over a length of two hundred metres. N. Saliby (Damascus) reports on it in a brief note (55). For a plan of the site see Atlas Plate 12 (A 71). During the excavation a part of the North-Western sector of the wall was cleared; it is 2.50 m. wide and it is built of stone entirely. Particulars are a flight of stairs, a round tower and a square tower.

M. Gawlikowski in ‘La première enceinte de Palmyre’ (51-54) summarizes his article Les défenses de Palmyre, Syria 51 (1974), 231-242. Nomads of the desert had become the permanent inhabitants of the Palmyra oasis, which is irrigated by the Efqa spring. Whereas the Roman defence system of Dioleitian (see Atlas Plate 14 [A 78]) enclosed only the built-up city area, defence systems 1 and 2 encircled the oasis as a whole (see Atlas). Wall 1, the width of which is 2.40 m. and which was 3.60 m. high, parapet and merlons not included, was built of mudbrick on a stone socle. There were no towers along the line of this wall, which was not meant to withstand a siege but rather to stop the horse-riding nomads of the desert. It was an enclosure rather than a fortification. However, on the top of Mt Djebel Muntar, a name that means ‘look-out post’, stood a mighty tower measuring 14 x 14 m. (cf. Gawlikowski 1973, 12-20, Le rempart, at 13). The Damascus gate of the oasis enclosure, which was flanked by towers, has been excavated. The first oasis enceinte, for a plan of which see fig. 243, possibly dates from the third quarter of the first century B.C. According to the author it was built neither by Greeks (Seleucids) nor by Romans but by the local Palmyraeans themselves.

In the paper ‘Developments in Technology of Siegecraft and Fortification in the Greek World ca. 400-100 B.C.’ (305-313) A.W. McNicoll (Sydney) bases his comments on a series of fortified sites which were visited and studied by him in Anatolia and in the Near East. His approach is technical and historical rather than archaeological. For instance, the author observes that, as the Hellenistic age drew on, dwindling manpower and shortages of money prevented the planning and building of long circuits as had been constructed earlier at Alexandreia Troas, at Ephesus, at Herakleia-on-Mt Latmos, at Halikarnassus and at Seleukia Pieria. He sets the concept of static/passive defence against elastic/active defence. Important elements of an active defence were sally gates (posterns) and sorties. The consequences of the new technology of offensive artillery – of stone-throwing catapults that is – are discussed, and it is suggested that a stone-thrower (lithobolos or petrobolos) in a high position might have thrown as far as 400 m. In the view of McNicoll the improvement of the stone-throwing catapult and its use over a wide area were the result of Macedonian initiatives. The author has carefully analyzed sieges described in Diodorus Siculus, Polybius and Livy; and in a table (310) he demonstrates that between 322 and 303 many city defences were vulnerable when they came under attack. After the new catapult technology had been introduced these systems appeared to be obsolete. Henceforth, thicker curtains and very strong towers protected the vulnerable sectors. After ca 225 many attackers only used ladders; they assailed a city at a variety of points simultaneously. Fortifications built during this later period were compact, and curtains tended to become higher, sometimes consisting of two storeys.

The contribution of A. Wąsowicz (Warsaw) ‘Le système de défense des cités grecques sur les côtes septentrionales de la mer Noire’ (79-93) is broad and rich in bibliographical references. Although we are informed of the lack of fixed chronological points a pattern emerges. At first the Greek colonists on the Northern shores of the Black Sea lived in small open settlements. Later, they attempted to protect the territories controlled by them by means of long field walls or of walls lying a few kilometres away from a town, as was the case near Kalos Limen, Crimea, figs. 188-189. Eventually, it proved to be necessary to protect the habitats themselves. City walls arose, fortified villages came into being as well as complete territorial defence systems, including roads, watch towers and fortified farms with klæroi attached to them[12]. One wonders, Wąsowicz observes, if the artificial mounds in the plains had perhaps been thrown up as look-out locations, or whether they may perhaps conceal the remains of watch towers built of mud-brick[13]. Two Crimean inscriptions refer to teiche ‘forts’ ‘fortifications’, which word may be a technical term for the defences of the chor(a) (92), in the same way as Ps.-Syclax, in the fourth century B.C., used the word teichos for coastal fortress-towns such as Rhamnous, Sounion[14] and other places.

10 Compare Plate 52 (the Hellenistic city of Beroia) with Plates 53, 54, 58, 62 and 70 (later periods).
11 See further Frézouls 1971 and Grainger 1990.
12 Discussed more fully by Wąsowicz 1975 and Wąsowicz 1983; for the fortifications of Olbia see the book reviewed here figs. 163-168 and Atlas Plate 9 (A 59).
13 One may compare in this respect the coastal site North of Nea Artaki, Euboea, Greece, BSA 61, 1966, 66 (autopsy SCB).
A striking example of a teichos is Late Hellenistic Iluraton, which lies seventeen kilometres to the West of Pantikapaion on a steep hill along a major road, and which was laid-out as a compact fortified border town, fig. 170 (after V.G. Gajdukević). This comprehensive survey has an open eye for controversies and research lacunae. In 1981 Ir. V.P. Tolstikov (Moscow, Pushkin Museum), who was trained as an architect, defended his doctoral thesis The Fortifications of Ancient Bosporus. Here his paper ‘L’apport de la fortification à l’histoire du Bosphore antique’ (167-177) summarizes the main conclusions of his work. The Bosporan Kingdom was situated on the two sides of the Straits of Kerch (called the Kimmerian Bosporus in antiquity). Its territory was extensive and it comprised both native populations and a fair number of Greek towns, among which Pantikapaion (Kerch) was the leading city. The kingdom had come into being ca 480 B.C. as a bulwark against the raiding Scyths of the steppe. There are five subjects in Tolstikov’s paper: (1.) long field walls; (2.) the fortifications of the city of Pantikapaion; (3.) the fortified town of Tanais; (4.) a region protected by a chain of forts; and (5.) architecture, particulars.

One long field wall is the wall of Uzunlarskij on the Crimean peninsula; it is over 36 kilometres long (fig. 161, on the extreme left). The field wall of Tyritake, also on the Crimean peninsula, is 25 kilometres long (figs. 190 and 192); on the outside there is a ditch, 15 m. wide, 5 m. deep. The latter system protected the urbanized coastal areas around Pantikapaion against the Scyths. It may date back to ca 470 B.C.

Pantikapaion itself is an excavation project of the Pushkin Museum of Moscow, after intermittent earlier work in the years 1820-1858 initiated by P. Dubrux. The trace of the city wall can be established, fig. 198 and Atlas Plate 9 (A 53); date: third-second centuries B.C. There is a series of forts on the acropolis ridge. The colonial town of Tanais near the mouth of the River Don was an exposed settlement founded in 300-275 B.C. There is a square main fortress – one side is ca 200 m. long – surrounded by a wall with towers along its circuit. Against it another, smaller, quadrangular fort was built, also surrounded by a fortification wall, fig. 196. We are dealing here with the three centuries of the Hellenistic period. The outer ward may have been inhabited by a dependent population group. I believe that such compact garrison towns perhaps constituted a type that is also found elsewhere in the Graeco-Roman world. One could compare Olbia to the East of Massalia, the castrum of Ostia at the mouth of the River Tiber, and Iluraton, the frontier town built ca 50 B.C. (Crimea), fig. 170 and Atlas Plate 9 (A 54).

A chain of eleven forts existed along the coastline of the former island of Fantalovskij, which is the North-Westernmost part of the Taman peninsula to the East of the Straits of Kerch; figs. 171, 205-209, featuring the sites of Batarejka and Patraios. This coordinated defence system was operational from the second half of the first century B.C. till the beginning of the second century A.D., the time of the Emperor Trajan. The forts were surrounded by ditches; their walls rose on a socle of clay, and large mudbrick tiles constituted the construction material, stone being scarce in this region. Frames of beams reinforced the walls. For one gate of Patraios Tolstikov reconstructs a portcullis (katarrhaktes) as Lordkipanidze does for the Vani entrance gate (181; see below). In the Bosporan Kingdom city walls, fortress walls and the long field walls were usually provided with a moat. On the whole, as time passed, curtains and tower walls tended to become thicker. The sprawling circuits of Landschaftsstädte, like those of Syracuse (Atlas Plate 2 [A 9]), of Hellenistic Chalcis-in-Euboea, of Erythrae (Atlas Plate 8 [A 44]) or of Hellenistic Ephesus (Atlas Plate 8 [A 52]) are not in evidence. In sum, though largely in a Hellenic tradition, there are some local features in Bosporan fortification construction, for instance the long Crimean field walls and the mudbrick walls to the East of the Straits of Kerch. Excellent plans and reconstruction drawings are part of this study, which offers useful references to earlier Sovjet publications. Tolstikov embodies a tradition which is usually associated with Germany, that of the architect-archaeologist – the names of Krischen, Marzolff and Kienast spring to mind. To the East of the Black Sea, in the country called Colchis in antiquity, the inland hilltop site of Vani overlooks a fertile valley which branches off from the main West-East axis and highway of present-day Georgia. Its documented history spans the period from the eighth-seventh centuries B.C. to the middle of the first century B.C. Being protected by steep falls on almost all flanks it only needed a defence wall on the

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15 Xenophon used the word for the small fortified Boeotian country town of Kureus (Hell. VI, 4, 3). For the archaeological situation see Gauvin and Fossey 1985, reprinted in Fossey 1990, 157-168.

16 Discussed in the volume under review by J. Coupry (Hyères) ‘Les fortifications d’Olbia de Ligurie, propositions, questions’ (389-399), fig. 84 and Atlas Plate 7 (A 33).

17 Rebuffat 1974; proposed construction period: 350-340 B.C.

18 For an interpretation of the Fantalovskij sites see also 86, 89 (A. Wasowicz).

19 Bakhuizen 1972.

20 J.-P. Adam (Paris) is another example.
Northside, where access was easy. Fortifications were built here in the third century B.C. (at that time the settlement was a temple-city)\(^{21}\). O. Lordkipanidze (Tbilisi) reports on them (179-184); plan of the site with its defences fig. 222, plan of the defences themselves fig. 223. Excavations uncovered an entrance gate of the courtyard type, narrow and axial – for pedestrians and pack animals —, and an adjacent military battery with a semi-circular and an hexagonal tower at its far ends. To the rear of the 2.80 wide curtain between the towers just mentioned – its length is 15 m. —, in the lower parts, were casemate-like storerooms for ammunition and for stocks of food as is demonstrated by the discovery of stone balls and amphora remains. There is a second wall, 1.25 wide, on the inside. In some respects the situation is reminiscent of the ‘Große Batterie’ which is contiguous to the acropolis of Demetrias, Thessaly, Greece (the length of that battery was 151.85 m.; there were large towers at the far ends)\(^{22}\). The stone balls found at Vani are of various diameters, from 11.5 to 30 cm. The battery system was probably covered by a wooden floor, more than 6 m. wide, so that catapults could be mounted on it. The great number of roof tiles proves that the battery was entirely roofed-over. Balls and amphorae were also stored in the hexagonal tower. Vani was not a Greek city, and local archaeological elements are distinctly present, but its defensive potential was clearly influenced by Greek engineering of the Hellenistic period.

The last few decades have witnessed a remarkable increase of studies about the Phoenician endeavours in Sardinia, Sicily, Africa and Spain. All these regions were represented at the Valbonne symposium. In his paper ‘Osservazioni sulle fortificazioni puniche in Sardegna’ (229-240) G. Tore (Cagliari) points out that in Sardinia fortifications of Phoenician-Punic origin have been identified in a considerable number of locations, the majority of them in the Western and Southern parts of the island, fig. 68. There are urban systems (Tharros, Sulci, Bithia, Nora, Karales), fortresses (e.g. Monte Sirai and Pani Loriga), and small or larger ‘defensive systems’. Chronology points to the fourth century B.C. and before. After the earlier work by Barreca (1978) Tore now updates knowledge of the subject, especially on Tharros, Sulci and Monte Sirai. Barreca and Tore thus open up a new field of studies where comprehensive conclusions and answers to questions of dating are in most cases still beyond reach.

After earlier excavations along the fortifications of the Phoenician-Punic island city of Motya by J.I.S. Whitaker and B.S.J. Isserlin, A. Ciasca (Rome) presents a report on the recent research project ‘Fortificazioni di Mozia (Sicilia), Dati tecnici e proposta preliminare di periodizzazione’ (221-227). The defence walls, which show many repairs, surrounded the island. From the beginning towers stood along the circuit of the wall. Four main phases can be distinguished, but absolute chronology is difficult to establish. Was the sixth century B.C. an important construction period\(^{23}\)?

In ‘Fortification punique: les murailles de Kerkouane’ (241-250) M. Fantar (Tunis) offers a discussion of a Punic city on the coast of Cape Bon, Tunisia, where large scale excavations are being carried out. There is a double city wall, which is well-preserved in its lower parts. It probably dates back to the first half of the third century B.C. A ca 10 m. wide corridor runs between the inner wall and the outer wall. There are towers, stairways, casemates, gates and posterns. This city, which had developed in flat country, was destroyed in the third century B.C. The enemies came from overseas: the Syracusans (Agathokles), and later the Romans. There were also other fortified Punic cities on Cape Bon; their archaeological exploration has hardly begun. In his paper on Spain ‘Les fortifications préromaines de l’aire ibérique’ (213-219) P. Rouillard (Montrouge) does not make mention of Punic fortifications.

There are many other significant contributions in the book but not all local and regional case studies need be summarized here. I shall mention a few papers that are of a more general interest. In ‘Inschriften und Festungsbau’ (299-304) F.G. Maier (Zürich) summarizes his two volume work dealing with inscriptions and fortifications (1959, 1961). He argues that inscriptions can only slightly widen our horizon: they often refer to local and special circumstances; therefore, generalizations are usually impossible. Inscriptions do, however, provide information on matters of vocabulary, on details of technical engineering like the construction of gate leaves\(^{24}\) or on the use of mudbrick and its coating. The subject enlightened most is finance. There is plenty of epigraphical material on donations, and on contributions of money in the form of loans. Another general paper is that of P.

\(^{21}\) For a comprehensive description of the site see Lordkipanidze 1991, for the temple-city 184-194.

\(^{22}\) See the plan ‘Demetrias, Großes Bollwerk’ in Marzolff 1980 (this volume contains a precise archaeological map of the remains of the fortification wall of that city) or Marzolff 1975, 49 and Sheet 2.

\(^{23}\) For the city itself see Isserlin 1982; plan: 118.

\(^{24}\) For new archaeological evidence on the construction of gates see Reinders 1988, 51-107. The Enceinte of New Halos, esp. 95-103 (acropolis gate); plan of the city in pocket.
Ducrey (Lausanne) ‘Les fortifications grecques: rôle, fonction, efficacité’ (133-142). Though the total cost of an enceinte has never been calculated, a balance of costs can be drawn up by looking at the ratio between cases in which the defence of a city was successful and cases in which it failed. The author lists sieges of cities for the period of the Peloponnesian War (431-404) and he reaches the conclusion that cities were rarely stormed and that sieges often did not succeed. Consequently, city walls might have had a dissuasive function. Attackers tried to circumvent the need of assaulting a fortified town by resorting to ruses or by instigating betrayal inside the city. In sum, granting the costliness of building a city wall, possessing an enceinte appears on the whole to have paid.

Three further papers, each of them concentrating on the technical aspects of city wall construction, are of great interest. Their subjects are the raw materials in construction, and the measurements of the final products. J.-C. Bessac (Montpellier) in ‘Approche des problèmes posés par la construction des remparts grecs en pierre’ (273-282) takes the building stones of the fortifications as his subject. His field work centers on the Provence (France), where indigenous, Greek and Roman sites are at present being investigated with particular attention to this type of research. Many new questions are asked – for instance, what was the ratio between the amount of stone quarried and the amount used in the end in construction –, and answers or estimates are often possible. First, the quarries have to be located; aerial photography can be helpful here. Then the quarry site has to be studied meticulously, and if possible, partly excavated, see figs. 99-100, plan and cross-section of a quarry. Inside the quarry the archaeologist may identify the place where the blocks were prepared for transport, the place called ‘work floor’ or ‘atelier’. The ancient quarrymen may have been itinerant artisans. In the La Couronne quarries of the Greek colonial city of Massalia, Gaul, they had built temporary dwellings and quays where stones were loaded and unloaded. Here too aerial photography can guide the field explorations of the archaeologist. Finally, a fortification and its constructional flaws cannot be studied optimally without taking into account the building stones, the tool marks on the stones or the wedge slots still visible in the quarries or on the stones. Personally I am of the opinion that this type of study which is of a practical character yields the best results in present fortification studies. In our publication of the Goritsa site (1992) we have tried to work along these lines (51-79, 98, 123) but Bessac, because of his technical background, decidedly probes deeper.

Another innovative study is that by G. Hallier (Marseille) ‘Pierre de taille et mesures normalisées: les enceintes hellénistiques d’Apollonia de Cyrénaique et de Massalia’ (251-271) with many footnotes and a rich bibliography. In this contribution poliorcetics is not treated; its subject is the high degree of planning and of standardization in ancient fortification architectonics. Hallier shows a preference for the ancient technical terms – basmos: plinth, socle; domoi: layers, courses; metapyrgia: curtains; etc. – and for the technical vocabulary of stoncutters and masons. The sites studied by him are Apollonia, the seaport of Cyrene, fortified in Early Hellenistic times (third century), and the harbour defences of Massalia, Gaul, of Late Hellenistic times (ca 100 B.C.). Survey plans of the two sites were made recently, Apollonia, fig. 109, Massalia, harbour, fig. 110. The author argues that reconstructing the ancient metrical modules – the ideal modules – should receive as much attention as reporting precise archaeological measurements. There is no doubt that the original modules can usually be found, in multiples of feet or, more often, of cubits (pecheis), a cubit being one-and-a-half foot, as remarked above. On both sites the Ptolemaic (Royal Egyptian) or Ionic foot of 0.35 m. and a cubit of 0.525 m. could be ascertained as the units of measure. The following multiples of cubits were found: 5, 15 (also 15 + 1), 20 (and 20 + 1), 40 (and 40 + 2). The width of the city wall of Massalia is 5 cubits. The fortress wall of Goritsa, which is in Doric feet (see Bakhuizen [coord.] 1992, 165), has the same width. At Apollonia the width of the wall is 10 cubits. The building stones – both systems were made of ashlar masonry – followed patterns of standardization too; a similar standardization has been established for the tiles of the mudbrick walls in Central Asia (see below). Feet and half cubits (spithamai) appear to have been the metrical units in stone masonry at Apollonia and Massalia.
Like Bessac, Hallier recommends that the incised marks of the ancient masons be studied carefully. The wreck of a ship transporting marked building stones from the La Couronne quarry to Massalia has been identified. The analytical approaches of Bessac and Hallier may be extended to other fortification systems, to those already published and to those coming under investigation in future.

Thirdly, the paper ‘Observations sur les remparts de brique crue d’Aï Khanoum et de Doura Europos’ (289-298) by P. Leriche (Paris) and O. Callot (Lyon) is a first step towards a theoretical analysis of mudbrick tile construction and of the labour forces needed for building the large fortified cities of Central Asia. According to the authors the study of mudbrick architecture is less developed than that of building in stone. For instance, what do the letter marks and ideograms on mudbrick tiles (see e.g. fig. 299, Maracanda) really indicate? The answer to the question is not yet known. The Greeks appear to have preferred mudbrick tile construction to building in pisé and to have introduced the marks on the tiles, in Greek letters. At Ai Khanum the mudbrick tiles are of standardized proportions: 5 square palms ( picturesque), one palm thick (there are four palms to a foot). Such a tile weighs forty kilograms. The authors estimate that the work force capable of building the imposing fortifications of the city of Ai Khanum in two seasons consisted of 4,000 men, half of whom were engaged in the fabrication of the tiles and in their transportation (plan of the site: Atlas Plate 16 [A 87]; also figs. 239, 310).

Walls made of pisé and of mudbrick tiles needed constant maintenance. These walls were lined with a brilliant, white coating that needed to be repaired or repainted every year. Major repairs of the fortifications were undertaken more than once. Sometimes a wall was razed completely and rebuilt anew. It was the raw material used, not fear of an enemy, that occasioned these repeated labour investments. For photographs of walls built of sun-dried mudbrick tiles see fig. 295, Maracanda, figs. 301 and 302, Maracanda, fig. 315, Ai Khanum, and fig. 314, Dura-Europos.

Another field of study which is developing at present is that of Byzantine defence systems. A first attempt at a historical sketch was published recently (Lawrence 1983). At the conference of Valbonne J.-M. Spieser (Strasbourg) contributed a paper ‘Philon de Byzance et les fortifications paléochrétiennes’ (363-368) discussing some aspects of the early Byzantine fortifications of Thessaloniki (which are tentatively dated by him around 450 A.D. [Spieser 1974]) and of a siege of the city by Slavs. It is remarkable that certain features of the practice of early Byzantine defence followed the prescriptions of the Middle Hellenistic author Philo of Byzantium (Syntaxis Mechanike). Spieser wonders whether the pax Romana had caused stagnation in Greek technical thinking, with the result that Greek-speaking early Byzantine engineers fell back on the latest handbook available in Greek, that of Philo. During the siege of Thessaloniki of 614 the Slavs threatened the harbour region. The inhabitants of the city constructed traps on the shore, sank caissons in the harbour which were equipped with oblique spiked rods, and blocked the harbour entrance with a chain and with a line of ships that were tied to each other by means of anchors. For all of this parallels can be found in Philo. Triangular and pentagonal towers are a characteristic of Byzantine fortification. This particular shape of the towers of Thessaloniki – they are triangular[28] – is also what Philo recommended; so were ditches and proteichismata, both of which have been ascertained for Byzantine Thessaloniki.

The article by R. Rebuffat ‘Les fortifications urbaines du monde romain’ (345-361) is enlightening, as much for the Roman world as it is for the Greek. To begin with, one is surprised to learn that general theoretical works as have been written for Greek fortification archaeology by scholars like Maier, Winter, Garlan, Lawrence and Adam or through the medium of this conference of Valbonne are virtually absent in Roman fortification studies; evidently the subject is too large[29]. Rebuffat outlines what is to be done, by defining the research targets. The author mentions the scarcity of well-dated sites, and points at the lack of poliorcetical commentary in archaeological publications. In his view texts of historians, epigraphy, and stratigraphical probings should be the foundations on which to build a comprehensive treatment of the subject – I would add archaeological surveys such as that of the town of Cosa[30]. Rebuffat remarks that a rough periodization is possible: (1.) the Roman Republic; (2.) the pax Romana of the Principate; here the author does not follow the theory of domestic insecurity; instead, he proposes to look for the motivation of city wall building in the manifestation of imperial power and in the expression of local urban pride[31]; (3.) the period of

[27] For a compact description of the fortifications see Leriche 1990.
[28] For another recently documented example of triangular towers see Reinders 1988, 175-178, The Byzantine Fort, for a plan fig. 102. For an example of pentagonal towers see De Boer 1988-1989 (Bulgaria; plan of the fort and excavation report).
[29] See, however, the informative survey of Lander 1984.
[31] On problems of imperial fortification policy see Isaac 1990.
anarchy (238-285); (4.) the period of recuperation (285-305): by the end of that period most city fortifications had been built; and (5.) the fourth and fifth centuries, during which the building of fortresses and of city defences continued (along with repairs).32

Rebuffat’s paper, with its excellent footnotes, offers many points of reference and comparison. The author asks attention for interests beyond the architectonical, taking into consideration the political context, the local circumstances and the cultural heritage; he also has an open eye for the Nachleben of a fortification. In this paper a historian is looking at a technological complex. When reading Rebuffat’s contribution one realizes that in Greek fortification studies some subjects have hardly been explored to the full, for instance ‘kings and the building of fortifications’, or, to some extent, ‘the manpower needed to build a fortification’33. In addition, linear defences of the type of Hadrian’s wall deserve to be studied sui generis. For the Greek world one may think of the long wall at Iasos34, or the field wall built in haste by Antioch III the Great at Thermopylae (191 B.C.; unpublished)35, and the long field wall formerly explained as the city wall of Pagasai36. Because of its broad ramifications attention may finally be drawn to the paper by M. Lenoir (Rome) ‘Le camp romain et l’urbanisme hellénistique et romain’ (329-336) which investigates the relations between fortified Roman camps and the planned, fortified towns and cities of the ancient world. First, the origin of the Roman camp is discussed. Its plan was certainly in agreement with the frequently recorded orthogonal lay-out pattern in Mediterranean urbanistics. It also reminds us of the contiguous to Roman camps; these canabae were under the supervision of the military. In the Magreb many a town grew out of canabae of army camps, becoming walled itself in due time. These are issues worthy of study, though the situation varied from province to province. I believe that it will also be useful to compare the military and the civilian fortified sites of the Greek world.

In sum, the informative book presents its readers with plans of a number of fortified ancient settlements, Saint-Blaise near Massalia, fig. 94, Ligurian Olbia, fig. 84, Velia, fig. 59, Moio della Civitella, near Velia, fig. 62A, Goritsa, Thessaly, fig. 130, Aghios Andreas, Siphnos, fig. 154, Melie, Ionia, fig. 153, Histria, fig. 211, Maa-Palaiokastro, Cyprus, fig. 274, Apollonia, Cyrenaica, fig. 109, Iluratón, Crimea, fig. 170, the field wall and city of Tyritake, Crimea, figs. 192 and 193, Tanais, fig. 196, Maracanda, Sogdiana, fig. 287, and Ai Khanum, Bactria, figs. 239 and 310, with reports on excavations and with discussions of archaeological and structural detail of enceintes (passim), with summaries of research in building materials, their transportation from the quarries and their standardization on the construction site (the contributions of Bessac, of Hallier, and of Lercide and Callot, see also the remarks by D. Adamesteanu on South Italy and Sicily 105-110), with expositions about the use of offensive and defensive artillery (McNicoll 305-313; the fortifications of Vani: 179-184; the Goritsa fortress: 315-321), about the costs and cost-effectiveness of urban defences (Ducrey 133-142; Maier 299-304; contrast: McNicoll 309-310),

33 See, however, the book reviewed here 135: ca 1530 workdays for building a tower of the city wall of Kyzikos (inscription; cost of the tower 9,200 drachmai); 169, n. 14: 4,000 workmen, or 40,000 work hours per day, over a period of one-and-a-half to two years for building the long field wall of Tyritake (estimate); and 292-293: 4,000 workmen for two seasons (the city walls of Ai Khanum; estimate).
34 F. Krischen, AA 1913, 475-476 (report of a lecture on field work); Bean and Cook 1957, 100-105; Winter 1971, 103, fig. 77, and 241-243; Lawrence 1979, 184-187; Adam 1982, 234.
35 Livy XXXVI, 16, 1-2 (cum dupli vallo fossaque et muro etiam), Appian XI (Σμύρνη), 18 (τείχος ... διπλοῦν); Pritchett 1965, 79-80.
36 RE s.v. Pagasai 1, Thessalische Stadt (Vol. 18, 2), 2299-2303 with plan at 2287-2290. The wall does not enclose an urban area, see Marzolf 1986, 381-382, Marzolf 1988, 27-28 and Marzolf 1992, 338-340 (‘Demetrias I’).
37 Olbia is mentioned in Strabo IV, 1, 5, p. 180C and IV, 1, 9, p. 184C; see also the book reviewed 389.
38 Another site to be taken into consideration is the Misipolis fort on the Attic-Bœotian border; for a plan see CalifStCrAnt 11 (1978), 235 (E. Vanderpool), for a recent description Lauter 1992, 81-84, The fortified deme of Oinoe (Myoupolis), updated plan at 83.
39 For Greek military camps see Reinders 1988, 181-182, 202, cf. 185 (Alexandria-on-the-Jaxartes). Discussing Halos, the author wonders whether it was the Macedonians who started building camps of an orthogonal lay-out.
with expositions about the spread of Greek fortification technology beyond the regions actually inhabited by Greeks and Macedonians (here the paper by H. Tréziny [Aix-en-Provence] ‘Les techniques grecques de fortification et leur diffusion à la périphérie du monde grec d’Occident’ [185-200] is of relevance, hesitatingly bringing up the question of itinerant Greek architects and groups of workmen), and with expositions about indigenous traditions of city fortification construction before the Greeks and the Macedonians arrived, as was the case in Central Asia, with expositions about Punic-Phoenician defence technology (Ciasca 221-227, Tore 229-240, Fantar 241-250) and finally with a comparison with research in Roman fortification and defence (Rebuffat 345-361, M. Lenoir 329-336) and with a discussion of Byzantine fortification practice as an inheritance of the Greek tradition (Spieser 363-368). In spite of the wealth of material collected the book has a critical rather than an accumulative character. The success of the Valbonne meeting derives from its perspective. Throughout these proceedings questions of theory and of research targets are brought up. The volume signifies a further step forward in the study of Greek defence systems.

I shall conclude the review by pausing over a few desiderata in the archaeology of Greek defence (cf. the contributions of Y. Garlan [Rennes] ‘Les fortifications grecques: bilan et perspectives de recherche’ [15-21] and of P. Lévêque [Besançon] ‘Conclusion générale’ [377-379]). There is a great need for publications of extant enceintes through the method of archaeological surveys on sheets that bring out the relief in contour lines. Bean and Cook made schematical plans of sites in Western Asia Minor (Caria)41. The monographs which were written on Miletus42 and on Samos (Kienast 1978), and also briefer studies such as were made on Thessalian Eretria (Blum 1982) and on Lycian Kydna43, represent a more detailed and technical approach. Many remaining enceintes are in a phase of physical deterioration if not threatened by partial destruction. Fortification studies need a sizeable corpus of fully published sites as a data base. Archaeological surveys are less expensive than excavations, and the overall insights gained are usually broad. As many a lecturer at the conference observed, it is important to know when an enceinte was built, repaired or completely reconstructed. Unfortunately, for most fortifications some doubts remain about the chronology. Research strategies may be sharpened on this score. Decay and demolition of circuits are subjects hardly ever studied in their own right. This aspect of fortifications could yield information about the history of the walls but it may also be of interest in itself. Certain components of fortifications merit special research. As an example I mention the acropolis or citadel. There are many types and many functions of acropoleis. As the citadel was an essential element of a Greek fortified city, insight into its functioning may lead to a better understanding of a city as a whole44. There is also room for looking more closely at the ideology associated with Greek city walls (Maier 299-300, Lévêque 378).

The subject of defence and fortification does not stop at cities. There exist a great many field forts and border defences, some of them perhaps planned or used as a system of control of a frontier45. Though some efforts are made in this book too little attention is paid to rural defences. Further, as remarked before, linear defences such as the wall across the isthmus of the Thracian Chersonesos46 – unpublished and unexplored as far as I know – or the Tyrritate wall featuring in the book – it protects the wider Pantikapaion chora and that of neighbouring towns – (169-170, fig. 192), are a subject in itself. The walls around the oases of Central Asia may be rendered in graphic form, on geomorphological maps. Then there is the subject of military signal towers. These are encountered everywhere in the Greek world47 but...
the subject is rarely approached in a general way, and the problems involved are major: problems of date and of contemporaneity, of functioning and of belonging; there is also the question whether towers were part of a signalling network, or are to be associated with one single endangered site, a village for instance. Finally, the question of fortification studies have matured to such a degree that great progress has been made recently and that directions of research have been clearly defined. The book under review is a work of great interest to be found.

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